DEVICE FOR LONGITUDINALLY GUIDING A MOTOR VEHICLE

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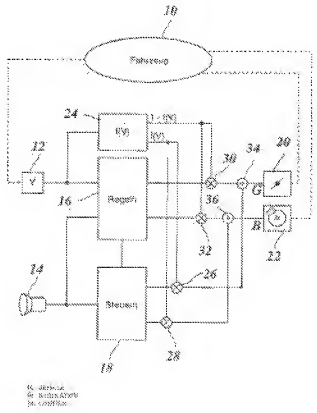
Abstract of DE 10153527 (A1)

The invention concerns a device for longitudinally guiding a motor vehicle (10), comprising a speed sensor (12) for measuring the vehicle running speed, a distance sensor (14) for measuring the distance relative to an obstacle located more or less in front of the vehicle (10), and a regulator acting on the driving system and the braking system (20, 22) of the vehicle and adjusting the running speed, in a closed regulating loop, as the case may be, on the basis of the distance relative to the obstacle, insofar as the running speed is greater than a specific speed. The invention is characterized in that it comprises a control device (18) which operates so as to control the driving and braking systems (20, 22) in case the running speeds are lower than the threshold speed.



Result Page

The invention relates to device to the longitudinal guide of a motor vehicle, with a speed sensor to the measurement of the vehicle speed of the vehicle, a distance sensor and to the measuring the distance to one for instance before the vehicle located obstacle and a controller, which intervene in the drive and brake system of the vehicle and which vehicle speed - if necessary in response from the distance to the obstacle - in a closed loop regulates, if the vehicle speed lies above a certain critical speed. Bottom "longitudinal guide" the control and control procedures understood are to become, itself on the movement of the vehicle in vehicle longitudinal direction relate, thus in particular the control or control of the vehicle speed here.

State of the art

There is speed governor known, which makes it possible to regulate the speed of the vehicle on a desire speed selected of the driver. An example of such a control system, which is also known as ACC system (adaptive Cruise control), becomes described in "adaptive Cruise control system - Aspects and development trend" of Winner, jokes, Uhler and Lichtenberg, Robert Bosch GmbH, in SOWS Technical PAPER Series 961010, international Congress & exposure, Detroit, 26. - 29. February 1996. Since these systems exhibit also a distance sensor, for example in the form of a radar detector, a stereo of camera system or such a thing, the vehicle speed can become also so controlled that an automatic appropriate safety margin is kept to a preceding vehicle.

Since however are possible not yet with the available sensor devices a complete detection and a safe assessment of the traffic surrounding field, these systems are suitable so far particularly for relative stable traffic conditions such as z. B. driving on an highway or a motorway. In the traffic in the city or with travels with low speed on winding distnces against it the uncertainties could lead with the detection of the relevant in each case target object to an accident risk. From this reason known ACC systems are so far so designed that they can be activated only above a certain critical speed, for example above 40 km/h.

It is already suggests extending the range of applications of the ACC of system to traffic conditions which become as stop & Go traffic designated and which arise for example with a Verkehrsstau or with viscous traffic. Also this traffic conditions are relative stable and are suitable therefore for an automatic longitudinal control. However the functionality must become then so extended that also starting and notion procedures automated to become to be able.

The speed sensor becomes so far formed by a system of dynamic wheel number of revolutions sensors, which are anyway present with vehicles with anti-skid system or automatic traction control. Since these wheel number of revolutions sensors can seize the angle increments of the wheels of the vehicle however only with a limited resolution, the speed signal becomes unreliable with low speeds unstable and. Also this is a reason for the fact that so far the control becomes exposed with low speeds.

Object, solution and advantages of the invention

Object of the invention is it to create a device to the longitudinal guide of a motor vehicle the one expansion of the automatic operation to smaller speeds possible, without a more complex speed sensor becomes required.

This object becomes dissolved according to invention by control means, which intervene with vehicle speeds below the critical speed controlling in the drive and brake system.

Advantageous embodiments of the invention result from the Unteransprüchen.

By the transition of control on control a longitudinal guide independent of the signal of the speed sensor becomes possible with vehicle speeds below the critical speed, so that incorrect or being missing signals of the speed sensor do not affect disrbing the behavior. In this way in particular a stop function can be realized, controlled into the conditions braked automatic with which the vehicle becomes for example in the case of the rear-end collision into a standing obstacle, approximately on an accumulating. Likewise stop & Go-function can be realized, braked not only with which the vehicle becomes automatic into the conditions but also, as soon as the traffic conditions permit this, which renewed a starting and an accelerating of the vehicle automatic controlled becomes.

The term "taxes" means in this connection that the signal of the speed sensor not when feedback signal becomes used. This does not exclude that the control behavior in response of the signals of the distance sensor becomes modified, which become for their part indirect by the independent movement of the vehicle affected.

Thus typical stop & Go-situation can be also controlled for the example, in which the obstacle, thus immediate vehicle standing before the own vehicle, starts and after short time again stops that. If the distance becomes the preceding vehicle enlarged, controlled starting of the own vehicle triggered. During this starting process can be intervened, even if the critical speed for the insertion of the control achieved not yet is, in response of the measured distance in the control, so that a too dense rear-end collision into the preceding vehicle becomes avoided. If required also a controlled deceleration can become into the conditions switched. If from the spacer and relative velocity data measured by the radar system of the distance sensor it results that the preceding vehicle drives only with very much low speed, can, in particular with vehicles with automatic transmission, which also of it consists controlled operation that the control means solve the brake and lets the vehicle with low speed roll, either with moderate gas or without gas and bottom exploitation of the number of revolutions rule function of the electronic engine management. If itself the preceding vehicle rapid remote, because itself the jam has resolved, the effected control means against it an other acceleration until the critical speed achieved is and is taken over the longitudinal guide again by the controller.

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Even if the signals of the speed sensor, in particular regarding their temporal resolution, for a satisfactory speed control not

more useful are, can them nevertheless, if necessary. after appropriate temporal averaging, for other purposes in the frame of the longitudinal guide evaluated become, for example the determination of the absolute speed of the preceding vehicle by comparison of the relative velocity and the own vehicle speed or the calculation of the turning radius durchfahrenen at present of the own vehicle on the basis the vehicle speed and the parallel yaw rate of the vehicle measured by an angular rate of yaw sensor. The knowledge of the turning radius can be for example by concern, if in connection with the selection of the target object for the longitudinal control or - monitoring a track switching of the own vehicle recognized will is to recognize or in order a bending procedure with which the stop & Go-function from safety reasons not used become should.

The change between taxes and rules can take place precipitously, via change-over with reaching the critical speed, preferably with a certain hysteresis. In another embodiment however also a flowing transition can take place, for example in the form that the output signals of the controller and the control means with speed-dependent weight factors become weighted and then added, so that one can over-dazzle by changing the weight factor gradual of the control on the control.

For the control functions by the control means preferably predetermined control programmes are processed, whose selection and/or their parameter are more variable in response of the traffic conditions detected by sensors.

In the following embodiments of the invention become more near explained on the basis the drawing.

Show:

Fig. 1 a block diagram of the device according to invention;

Fig. 2 a speed diagram to the explanation of change procedures between control and rule enterprise; and

Fig. 3 a time chart to the explanation of control functions for starting and brakes into the conditions.

Description of embodiments

In Fig. 1 device shown to the longitudinal guide of a motor vehicle 10 covers a speed sensor 12, that in known manner, for the example by commercial dynamic wheel number of revolutions sensors, the vehicle speed of the vehicle measures, a distance sensor 14, for example in the form of a radar detector, that the distance, the relative velocity and if necessary. the direction to immediate other vehicle held driving before the own vehicle 10 or measures, a controller 16 and control means 18, which both can affect in the driving system 20 and the brake system 22 of the vehicle 10 engage and so the acceleration and brake behavior of the vehicle.

As example assumed is to become that it acts with the vehicle 10 around a vehicle with automatic transmission, although the invention is more applicable in principle, also on the hand located adjustments, also with vehicles with gearbox. The engagement into the driving system 20 made by an electronic signal, which is in its importance of the actuation of the accelerator equivalent by the driver. Corresponding one the made engagement into the brake system 22 by an electronic signal, which is the actuation of the brake pedal equivalent. The speed change of the vehicle 10 caused by these engagements becomes of the speed sensor 12 detected and 16 reported as feedback signal to the controller, so that a closed loop becomes formed.

In a so called ACC mode (adaptive Cruise control) the control means are 18 inactive, and the vehicle speed becomes alone 16 controlled by the controller. If by the distance sensor 14 no preceding vehicle is located, a made control on a desire speed set of the driver. If the distance sensor 14 locates or several preceding vehicles, that becomes immediate selected on the own lane preceding vehicles as target object, and the speed becomes so controlled that to this vehicle a safe distance is kept, which is in suitable way of the current vehicle speed dependent. These rule functions of a ACC of system are as such known and become not explained therefore here.

The ACC function is more activatable only with vehicle speeds above a certain critical speed of for example 3 km/h, since 12 not precise enough detected with smaller speeds the current vehicle speed can become with the help of the speed sensor, so that a stable control is not in a closed loop possible. With low speed therefore 16 on the control means 18 switched become from the controller. The controller 16 and the control means 18 can become by separate microcomputers or by software modules in the same microcomputer a formed. Between the controller 16 and the control means 18 is a data exchange possible, so that the control means can access informations, which are more available in the controller, and reverse. Differently than the controller 16 however the control means 18 immediate can react only to the detection signals of the distance sensor 14 and not to the signal of the speed sensor 12.

The changeover between taxes and rules becomes in the illustrated example by a switching module 24 effected, that the signal of the speed sensor 12 takes up and from it a speed-dependent weight factor f (V) calculated. By multiplication members 26 and 28 becomes for the driving system the 20 and the brake system of 22 certain output signals of the control means 18 with the weight factor f (V) weighted.

Corresponding ones become by multiplication members 30 and 32 for the driving system the 20 and the brake system of 22 certain output signals of the controller 16 with the weight factor 1 - f (V) weighted. The weighted output signals become 36 added at points of summation 34, and the sums become as gas control signal G and as brake control signal B the driving system 20 and/or. the brake system 22 supplied. If the weight factor f (V) has the value 1, thus a pure control takes place, during with f (V) = 0 a pure control takes place.

A possible connection between the vehicle speed V and the weight factor f (V) becomes by in Fig. 2 in solid lines shown hysteresis curve 38 illustrated. If the ACC function active is and the vehicle speed V, approximately in the case of the rear-end collision into an accumulating, a bottom certain critical speed VL (z. B. 3 km/h) drops, then f (V) becomes precipitous of 0 to 1 increased, D. h., it becomes switched of control on control. If in the frame of the control the vehicle speed increases a value something above VL, becomes again precipitously to control shifts back. As alternative for this illustrated those broken shown curve 40 a flowing transition between control and control.

Two typical control functions of the control means 18, i.e. brakes into the conditions and starting from the conditions, are bottom reference on Fig. 3 explained becomes.

The fat solid curve 42 in Fig. 3 gives if the vehicle to the conditions braked becomes, in arbitrary units the time course of the gas control signal G on, which becomes the driving system 20 supplied. Those fat and broken shown curve 44 indicates the corresponding course of the braking of control signal B. Up to the time t0 still the controller is 16 active. In the frame of the spacerdependent control the vehicle becomes delayed. The gas control signal G has the value 0, and the braking control signal B has a certain value, which becomes 16 certain by the function of the controller. At present t0 sinks the vehicle speed of bottom VL, and it becomes in accordance with the hysteresis curve 38 (Fig. 2) on taxes switched. So that an abrupt transition becomes avoided, the initial values of the gas control signal G and the brake control signal B, which becomes 18 outputted of the control means, are 16 adapted to the respective values of the controller. The control means 18 effected then within the

time interval between t0 and T1 a linear increase of the braking of control signal on a value, which is high enough to brake the vehicle between the times t0 and T1 controlled into the conditions. The gas control signal G keeps meanwhile the value 0. Starting from the time T1 those becomes brake control signal on the achieved value held, so that the vehicle does not roll again.

The control means 18 are so formed that it can vary the time T1 and corresponding also the increase rate of the brake control signal between t0 and T1 in response of the spacer and relative velocity data transmitted of the distance sensor 14. In this way the notion procedure becomes so controlled that it does not drive the vehicle 10 on the one hand to abrupt made and on the other hand not to dense into the target object.

The curves 46 and 48 shown in thinner lines illustrate a starting from the conditions. The curve 46 indicates the gas control signal G and the curve 48 the brake control signal B. Up to the time t0 the brake held becomes, and the gas control signal is 0. At present t0 recognizes the distance sensor 14 that the preceding vehicle started, and in the control means 18 the automatic starting function triggered becomes. The brake control signal 48 drops within short time on 0, and as soon as the brake is dissolved, the gas control signal (curve 46) becomes gradual increased on a relative high value, so that the vehicle becomes accelerated. After reaching a peak value the gas control signal is again somewhat taken back, so that the vehicle with moderate acceleration becomes other accelerated. The accurate time course of the curve 46 can become in the control means 18 for example by table turn or by a mathematical function certain. With continued acceleration the achieved vehicle sometime the critical speed VL and hysteresis jump speed, at which rules switched becomes.

During the acceleration phase the signal of the distance sensor becomes 14 also 18 monitored of the control means, and if required the gas control signal 46 is taken back or it becomes again the control function "brakes into the conditions" initiated.

With that here illustrated example are the stop function (brakes into the conditions) and the starting function, whose embodiment the control means become 18 required, like that with the conventional ACC functions combined that the change between stop & Go and the ACC mode without engagement of the driver takes place. It can be however convenient to permit functions as brakes into the conditions and starting from the conditions only in the frame particular stop & Go of a function which must become activated of the driver by a special command. Also the change of the stop & Go mode into the ACC mode is then only possible by active engagement of the driver (for example by input of a key instruction). In this case preferably the ACC mode is as pure rule mode designed and only above 20 km/h more activatable, while in the stop & Go-mode can take place changes between rules and taxes, but in the rule enterprise the desire speed on for example maximum 40 km/h limited is.

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1. Device to the longitudinal guide of a motor vehicle (10), with a speed sensor (12) to the measurement of the vehicle speed (V) of the vehicle, a distance sensor (14) to the measuring the distance to one for instance before the vehicle (10) located obstacle and a controller (16), that in the drive and brake system (20, 22) of the vehicle intervenes and the vehicle speed - if necessary. in response from the distance to the obstacle - in a closed loop, if the vehicle speed (V) lies above a certain critical speed (VL), characterized regulates by control means (18), which intervene with vehicle speeds below the critical speed (VL) controlling in the drive and brake system (20, 22).

2. Device according to claim 1, characterised in that in the control means (18) a stop function to automatic brakes of the vehicle is implemented into the conditions.

3. Process according to claim 1 or 2, characterised in that in the control means (18) a starting function to the automatic control of starting the vehicle from the conditions is implemented.

4. Device according to claim 2 or 3, characterised in that the stop function and/or the starting function in response of signals of the distance sensor (14) more activatable and deactivatable is.

5. Device after one of the managing claims, characterized by a switching module (24) to the automatic changeover between taxes and rules in response of the vehicle speed (V)

6. Device according to claim 5, characterised in that the change-over between taxes and rules with a hysteresis function (38) made.

7. Device according to claim 5, characterised in that the transition between rules and taxes flowing, by over screens of the output signals of the control means (18) and the controller (16) made.

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Fig. 1

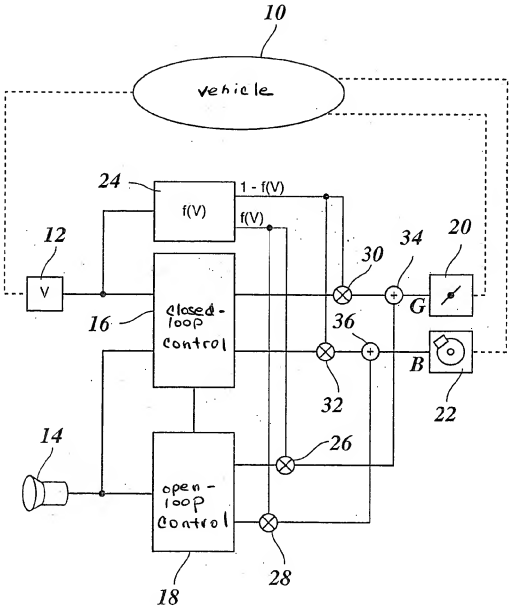
10
vehicle
24
f(V)
1 - f(V)
f(V)
12
V
16
closed-loop control
30
34
20
G
36
B
22
32
14
26
open-loop control
28
18

Fig. 2

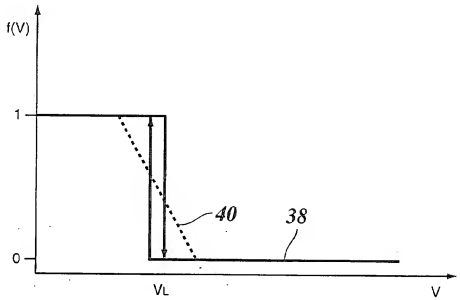

Fig. 3